W. UDO SCHRÖDER'S Nuclear Science Research Group has continued research in radio-chemistry, heavy-ion reaction dynamics, advanced detector development, as well as development of laser induced acceleration of ions for nuclear Science (LIANS).

Theoretical work based on a simple but successful quantum statistical model of finite nuclei has addressed one of the major gaps in our understanding of the excitation modes and the stability of atomic nuclei. A new, fundamental mode of nuclear decay ("spinodal vaporization") has been found responsible for a host of previously enigmatic and misinterpreted experimental observations such as the existence of a limit to the temperature that can be sustained by nuclei. In heavy-ion experiments conducted at the Italian laboratory LNS Catania at low and intermediate bombarding energies, the group has made several unexpected observations: At intermediate energies, evidence has been found for unusual cluster disintegration of primary reaction products on a time scale so fast that the proximity of their nuclear reaction partners is felt. Of specific interest are the isotopic regularities seen in the final products which could reflect the isospin dependence of the nuclear tensile strength, i.e., the nuclear equation of state. Even more exciting is a discovery made by Udo's group at a low bombarding energy. Here, a theoretically long postulated inability of nuclei to sustain and dissipate the impact of an energetic projectile in a head-on collision may now have been discovered. Observed was a dynamic prompt fission process in Kr+Ca head-on collisions at 10 MeV per nucleon, where the formation of equilibrated compound nuclei had been predicted.

Radio-chemical investigations of transport phenomena of tritium in metals have included thermal desorption and plasma induced sputtering measurements on a series of different materials. Results for metallic samples covered in presumably protective surface films have demonstrated an unexpected complexity of tritium diffusion through lattices and surface layers of various metals. The group's understanding of tritium adhesion to metal films is hoped to help in the future with laser-induced generation of tritium beams for light-ion interactions of interest to studies of stellar fuel cycles. Most recent experiments by the group at the Omega/EP laser system have been successful in producing well-controlled beams of MeV deuterons.

Eric Henry presented results of his Ph.D. work at the "International Workshop on the Many facets of EOS and Clustering" in Catania/Italy. Jan Toke lectured at International Workshop on Nuclear Dynamics and Thermodynamics (College Station (TX)). Udo gave invited lectures at this meeting and at several other international conferences, including the Indianapolis Meeting of the ACS, the international conference "75-years of Nuclear Fission: Present status and future perspectives" (BARC, Mumbay/India), and presented a seminar at the Inter-University Research Centre, New Delhi/India. He also gave a week of lectures at the ACS Nuclear Chemistry Summer School at Brookhaven National Laboratory.

PUBLICATIONS

"Spinodal Vaporization - a Critical and Imposing Decay Mode of Highly Excited Nuclear Systems, J. Tõke and W.U. Schröder, Physics Letters B 734 (2014) 364–368.

"Evidence for a Novel Reaction Mechanism of a Prompt Shock-Induced Fission Following the Fusion of 78Kr and 40Ca Nuclei at E/A =10 MeV," E. Henry, J. Tõke, S. Nyibule, M. Quinlan, W.U. Schröder, Report UR-NCUR 14-032, 2013, arXiv:1404.3758 (2014).
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